

THE GEOGRAPHICAL DISTRIBUTION OF *DANAIDA PLEXIPPUS*, L.
(*DANAIS ARCHIPPUS*, F.) WITH ESPECIAL REFERENCE
TO ITS RECENT MIGRATIONS.

BY JAMES J. WALKER, M.A., R.N., F.L.S.

In a former volume of this Magazine (Ent. Mo. Mag., vol. XXII, pp. 217-224), shortly after the capture of a considerable number of specimens of *Danaida plexippus* in Britain had been recorded in our current Entomological periodicals, I was induced to publish some notes on this most interesting butterfly embodying my observations made during a voyage in H.M.S. "Kingfisher" in the Eastern and Central Pacific Ocean, and to speculate on the probable causes of the rapid spread of the species at that time taking place across the warmer parts of that ocean and the Atlantic. In the long interval that has elapsed since this paper was written, two more voyages to Australia and the Western Pacific, where the butterfly has now presumably established itself as a permanent member of the insect fauna of these regions, have enabled me to add very materially to my experiences on the subject of the life-history and the wanderings of *D. plexippus*. I therefore venture to submit to the readers of this Magazine a summary of the history of the recent wonderful extension of its geographical range, in the hope that a useful purpose will be served in bringing together the scattered records of many observers during the last half-century or more, and that these records will prove to be of interest to Entomologists in general.

Although up to a very recent date *Danaida plexippus*—to give the butterfly its most recent generic name as adopted by Dr. Karl Jordan and Prof. E. B. Poulton—has been regarded as an undoubted native of the New World, the evidence brought forward by the last-named distinguished Entomologist (Trans. Ent. Soc. Lond., 1908, pp. 449-452: Charles Darwin and the Origin of Species, pp. 152-164, 204 [1909]) appears, to myself at any rate, to be conclusive that so far from this being the case, it is really "a member of an Old World genus that has invaded the New." Its striking dissimilarity from all but a very few (obviously allied) forms of the multitude of American Danaine butterflies, and its equally striking resemblance in all its stages to the widely distributed and abundant Oriental *D. genutia*, Cram., had, it is true, not escaped notice previous to the appearance of Prof. Poulton's paper; but I cannot do better than to quote the learned Professor's own words in his masterly essay on "Mimicry in North American Butterflies" (Darwin and the Origin of Species, pp. 159-160). "The suggestion

might perhaps be made that the New World forms of *Danaida* are the more ancestral, and that those of the Old World have been derived from them by migration westward. There is no reason for believing that the Danaidas of either geographical area possess a more primitive structure than those of the other; we are therefore driven to consult other lines of evidence. The following comparisons clearly indicate that *Danaida* is an Old World genus which has invaded America at no very remote period:—(1) the far larger number of the Old World forms and the greater degree of specialization by which some of them are distinguished; (2) the place of *Danaida* as one out of a number of nearly related genera making up the *Danaini*, a large and dominant Old World group, *per contra* its isolated position in the New World; (3) the highly developed and complex mimetic relationships of the Old World Danaidas." Again (l.c., p. 162), "There can be little doubt that *D. plexippus* invaded America by way of the north, probably following the line of the Aleutian Islands. In North America it possesses an astonishing distribution for a member of so tropical a group, ranging immensely further north than any Danaide in the world. Furthermore *D. genutia*, the probable representative of its Old World ancestor, extends far beyond the tropics into Western and Central China. A study of the distribution of the Asclepiad food-plants on the eastern coast of Asia might perhaps throw light on the problem." Further (l.c., p. 163), "It is probable that both the American Danaidas as they pressed southwards were 'held up' for a considerable time at the northern borders of the Neotropical Region, unable at first to penetrate that crowded area. Finally they burst their way through, and are now abundant throughout all the warmer parts of the region, the forms of *plexippus* extending further into the temperate south, just as in the Northern Hemisphere they range further north than those of *berenice*. We are made to realize the recent date of the invasion of South America when we remember that nowhere else in the world do Danaide butterflies of equal abundance range through a crowded area without producing any effect on any member of the Lepidopterous fauna, or without themselves being affected thereby."

That the wandering instinct which in all probability carried the ancestor of *D. plexippus* in past ages from the Old World to the New still survives in full strength in its present-day descendant, is evident from its well-known migratory habits in North America, well summarized by the late Mr. J. W. Tutt in his admirable series of papers "Migration and Dispersal of Insects" (*Ent. Record*, 1900, pp. 182-6,

206-9). But as he goes on to say (l.c., p. 236), "Whatever interest may attach to what we may term the internal migrations of *Anosia archippus* within the Nearctic region, much greater interest is felt in its movements to distant parts of the world." It is the history of these movements that I now proceed to consider.

THE WESTWARD MIGRATION OF *DANAIDA PLEXIPPUS*.

I. NEW ZEALAND.

It is not a little singular that the first definite record of the occurrence of *D. plexippus* outside the American Continent was from so remote a locality as the North Island of New Zealand, at about the time when it first became a British colony.

In the "Transactions of the New Zealand Institute," vol. VI, pp. 183-6 (1874), Mr. R. W. Fereday published an interesting paper "Observations on the Occurrence of a Butterfly new to New Zealand," he having received a specimen of "a large handsome butterfly of the genus *Danais*," captured by Mr. F. H. Meinertzhagen at Waimarama, Hawke Bay, N.I., and identified as "*Danais erippus*" from a New South Wales specimen in the Canterbury Museum, Christchurch, sent by Mr. C. French—the insect having by that time established itself in Australia. Mr. Fereday, who in his paper adopts the Cramerian name *berenice* for the insect in question, thus proceeds (l.c., p. 183), "From Dr. Hector I have also received a specimen of this butterfly, taken last summer at Hokitika (west coast of South Island), where he saw it in great abundance; and since the capture of the first, Mr. Meinertzhagen has taken several more specimens at Waimarama. . . . He informs me that wherever he has seen the butterfly it has been flying high, but not swiftly, in sunny sheltered places among trees, and settling on them. He also saw it travelling fast over the country along the coast. The first he saw early in November, and the last he took the first week in April. All the Maories to whom he showed the butterfly said they knew it, and the old Maories say it is called 'Kākāhū,' and is in some years very plentiful. The caterpillar, they tell him, was very plentiful this year, and feeds on the pollen of the gourd which they grow in that part of the country (Hawke Bay). *They are unanimous in saying that the butterfly was there before any white man came*" (the italics are my own), "and the Rev. W. Colenso of Hawke Bay told Mr. Meinertzhagen that he saw it many years ago."

Mr. Meinertzhagen also obtained from his neighbour, Mr. Nairn, a coloured sketch made from memory, but clearly recognisable from

the description given as that of the larva of *D. plexippus*; also three pupæ “short and stumpy, of a pale green colour and dotted with gold on the edge which covers the wings. The Maori to whom he showed them recognised them as the pupæ of the *Danaïs*. Unfortunately the rats got at them and destroyed them” These larvæ were found on “the *Gomphocarpus ovata*, one of the milk-producing plants, and a native of the Cape of Good Hope.”

In the same periodical for 1877 (Tr. N. Z. I., vol. X, pp. 276-280) appears an interesting account by the Rev. W. Colenso of his breeding “*Danaïs berenice*” from larvæ found feeding on some “cotton-plants” grown from seed at Meeanee, Hawke Bay. This paper elicited a letter, under date February 17th, 1878, to Mr. Colenso from Mr. F. W. C. Sturm, which appears in full in Tr. N. Z. I., vol. XI, p. 305, and is of very great interest as fixing a fairly definite date when *D. plexippus* first came under the notice of a competent observer in New Zealand. Mr. Sturm thus writes—“In regard to the butterfly, *Danaïs berenice*, or a closely allied species (as per your paper on the same) the first time I saw it was at the Reinga, up the Wairoa River in Hawke Bay, in December, 1840, or January, 1841. In 1848 I captured a number at the Waiau, a tributary to the Wairoa; I cannot recollect how many, but it must have been eight or nine at least. Again, in 1861, I captured three on the Rangatikei River one of which I have still in my collection. Four years back I saw three or four in my garden here and two years ago there was a great number in my gardens, always keeping about the Lombardy poplars and *Houheria populnea*. I certainly believe the butterfly to be indigenous and not introduced; and my observations of it fully coincide with yours that while in certain years it is plentiful, in other years it is not to be seen.”

Unless we accept as true the statement made by the Maoris to Mr. Meinertzhagen “that the butterfly was there before any white men came,” which may point to a still earlier invasion of New Zealand by *D. plexippus*, Mr. Sturm’s record given above is, as far as I can ascertain, the first indication of the great migrations of the insect.

In more recent years, although *D. plexippus* has been several times recorded in New Zealand, mainly from the neighbourhood of Cook’s Straits (Hudson, New Zealand Moths and Butterflies, pp. 102-3) it seems except in one instance always to have occurred sparingly or singly, and would appear to be barely, if at all, holding its own in the Islands. This exception was at Wanganui (N. I.) in 1894, when

DESIDERATA.

I am at present engaged in working out the life-history of *Xestobium tessellatum*, an insect that has done a great deal of damage to the roof of Westminster Hall. As the matter is one of great interest to the public, I should be very grateful for any assistance; living beetles or affected timber being required for investigation.—JAMES W. MUNRO, Imperial College of Science and Technology, S. Kensington, S.W.

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Mr. P. A. Marshall recorded it (Tr. N. Z. I., vol. XXVIII, p. 313) as "breeding in hundreds in Wanganui on plants of a species of *Gomphocarpus* in gardens, but not appearing the following summer." During the thirteen months, in 1901 and 1902, that I was continuously in New Zealand, I never had the good fortune to see a specimen on the wing, and my friend Mr. G. V. Hudson regarded it as distinctly a rarity in the Islands. *Gomphocarpus fruticosus*, R. Br. (*Asclepiadææ*), the ordinary food of the larva at Sydney, is sometimes grown in New Zealand gardens under the name of the "cotton-plant," from the large seed-capsules full of white cottony down enveloping the minute seeds; and the West Indian *Asclepias nivea*, L., is recorded as "an escape from gardens near Auckland" (Cheeseman, Tr. N. Z. I., vol. XV, p. 287), but neither of these plants appear to have become naturalized to anything like the same extent as is the case with the first-named in Australia at the present time.

II. THE CENTRAL AND NORTH PACIFIC ISLANDS.

My own observations on the extension of the range of *Danaïda plexippus* to the Marquesas, Society, Cook, Hervey, and other island groups in mid-Pacific, as well as those of Mr. G. F. Mathew in the islands further to the west in that ocean, which appeared in my former paper in this Magazine (l.c., pp. 219, 220, 224), have been embodied by Dr. S. H. Scudder in the admirable history of the butterfly in his monumental work, "The Butterflies of the Eastern United States and Canada." (Cambridge, Mass., 1889). The section entitled "Commercial Extension in Recent Years" (vol. I, p. 730 *et seq.*), deals with the question of its range over the Pacific Islands in so thorough and interesting a manner, that I make no apology for quoting it almost in full, though, as will be seen later on, I am by no means in complete agreement with some of his suggestions relative to the "means of dispersal."

"Among the most interesting points in the distribution of this butterfly is the fact that within 30 years or a little more it has begun to invade so many regions of the world as to make one think at first blush that it may some day vie with *Vanessa cardui* in cosmopolitan character. The facts concerning its exotic distribution, so far as I have been able to gather them, are as follows:—It first reached the Hawaiian Islands, fully two thousand miles from America, some time not far from 1845 to 1850. At any rate we have the direct statement of Dr. Luther H. Gulick who was born upon the islands, that in 1852, after eleven

years absence, he returned to the islands, and his brother drew his attention to the fact that *Asclepias* had been introduced during his absence, and had already become a troublesome weed; that his brother had noticed that where the milk weed appeared, there also the *Anosia* made its advent, a butterfly unknown until after the milk weed had been introduced. We next find it in 1857 as far away as the Island of Ponape (Ascension), one of the Caroline Islands in Micronesia, a distance of another two thousand miles or so from the Hawaiian Islands. This fact we also owe to Dr. Gulick's personal testimony. He was for some time a resident of Ponape, and the butterfly was first seen by him in the year mentioned, not long after he had discovered several young milk weeds, which had sprung up in earth in which various other plants had been brought from the Hawaiian Islands in a Wardian case. The plants were brought in a missionary vessel which sailed from Honolulu, and on its way to Ponape touched only at Apaiang of the Gilbert Islands and Ebon of the Marshall group, both low coral atolls, and at Kusaie, which is of basaltic formation and richly clothed with verdure, but where the butterfly did not then occur. It is evidently impossible that in a voyage consisting in the whole of fifty-four days, the insect in any stage or stages could have been transported in the Wardian case itself, for it easily undergoes all its transformations in warm regions in a month or five weeks at most. If the butterflies were introduced at that time, as there is every reason to believe from Dr. Gulick's accounts, there seems no other supposition possible than that an impregnated female flew into the hold of the vessel while lading at Honolulu, and was carried perforce to Ponape, or perhaps a pair of butterflies. It would certainly be absurd to suppose that a gravid female could have flown over the two or three thousand miles of ocean, and in addition have appeared in Ascension Island almost simultaneously with a few plants of *Asclepias*. As the butterflies pass the entire winter in hibernation, and then lay eggs in the spring, there is nothing in any way surprising in Dr. Gulick's statements, unless it be impossible for an impregnated female to live in enforced hibernation a couple of months without laying, when it would be necessary to suppose a pair to have been transported, which would of course be more extraordinary.

“Granting our explanation to be just, it is highly probable that it was from this single ancestor, or pair, that the swarms, which have already now spread over the entire South Seas, in many of which it is the commonest butterfly known, have sprung. Our knowledge of the

period and extent of this later distribution we owe largely to Professor Semper,* who states that the butterfly was first seen in 1863 by Captain Rachan, one of numerous collectors of the Museum Godeffroy on the islands of the Tonga or Friendly group, again nearly 2,000 miles from Ponape. The first specimen actually obtained was secured in 1866 on Niuaufau, one of the islands of this group, and in the same year larvæ were discovered on *Asclepias curassavica*, a plant now spread quite as far as the Anosia. We now begin to be able to record in part the rapidity of its spread; for it was first seen in Tutuilla, one of the islands of the neighbouring Samoan group, in 1867, but upon Upolu and Savaii, islands of the same Samoan group, distant at the nearest some fifty miles, not until 1869. Yet in Upolu it became one of the commonest butterflies in 1870. It was not until 1868 that it was discovered at Tongabalu (*sic*), one of the southern of the Tonga Islands, but in the same year it was seen in the open sea five hundred nautical miles to the south-east. In 1869 it had appeared at Roratonga, one of the Hervey Islands, five hundred miles or more away. In 1870 to 1872 it was found on Huahine and Tahiti, of the Society Islands, again five hundred miles or more distant. So far the account of Professor Semper. But Mr. James J. Walker, who sailed in the South Seas in 1883 and found Anosia nearly everywhere one of the commonest butterflies, states that he was informed at the Marquesas Islands, which lie to the north-east of the Society Islands, again at a distance of some five hundred miles, by a Roman Catholic missionary residing there forty years, that he distinctly remembered seeing the first specimen there about 1860; it should be noted that the Marquesas Islands are nearly as distant in a south-easterly direction from the Hawaiian Islands as the Carolines are to the south-west. Mr. Walker also found the butterfly on the Hervey and Society Islands, and at Oparou, one of the Andaman (*sic*!) group, in 28° south latitude, though it had not then reached Pitcairn Island, which lies much farther east and somewhat farther north. These statistics indicate its movements from the Caroline Islands in an easterly and south-easterly direction, but it has also left its mark by the way in a southward extension from this route of travel. It reached Lord Howe's Islands in 1870, Clarence River on the opposite coast of Australia in 1871, Melbourne in 1872, and has now extended to Celebes, and, according to Kirby, to Java.

* G. Semper on the appearance of *Danais archippus* in the South Sea Islands, Australia and Celebes: Journ. Mus. Godeffroy, II, pp. 117-119 (1873).

“It thus appears that it now possesses a territory in the Pacific Ocean of at least 110° of longitude and 65° of latitude. But this is by no means all. It has moved also in some strange way in the opposite direction from the American Continent.”

In all these widely separated island-groups *Danaida plexippus* appears to have become one of the commonest butterflies in a very few years after its arrival, and the following passage from that delightful narrative of Pacific voyaging, “South Sea Bubbles,” shows that not only was this the case in one at least of these groups, but that its American origin was there a matter of common knowledge. Writing of Samoa in 1870, one of the authors says:—“Coming down from our ravine, we pass through a wilderness of imported plants and shrubs, flourishing in wild luxuriance. That red and brown flower, which makes such pretty wreaths for the girls’ heads, and the down from whose pods is so dangerous to the eyes, is an importation, Heaven knows how, from America; and not only is it an importation, but it has imported its own butterfly with it, that splendid red and brown fellow who looks as if he had got half his colour from his native flower.” More than twenty years after this date, Mrs. Jane Fraser (*Ent. Mo. Mag.*, vol. XXX, p. 149) notes *D. plexippus* as “one of the first butterflies to be noticed in the Navigator (Samoa) Islands” and in Upolu it was very much at home, but was decidedly more numerous at a few hundred feet above the sea.

I am not aware of any very recent records from the Central Pacific, but I think there can be no reasonable doubt that both the butterfly and its most usual food-plant, are firmly and permanently established in the larger groups of islands. But as regards Micronesia, which consists with very few exceptions of coral atolls of no great size, and elevated only a few feet above the ocean level, it would appear that there *D. plexippus* exists on a very precarious tenure, and perhaps not at all as a permanent resident; though, as already stated, Ponape in the Carolines has been suggested by Dr. Scudder as one of the chief centres of distribution in the Pacific. Mr. Mathew (*Ent. Mo. Mag.*, vol. XXII, p. 220) did not meet with it in his cruise among the Gilbert, Ellice, Marshall, and Caroline Islands, though he saw *Asclepias* in the last-named group; neither is it included in the list of butterflies collected by the Rev. S. J. Whitmee in the Ellice Islands (*A. G. Butler, P.Z.S.*, 1878, pp. 296-7), nor in those found by Mr. C. M. Woodford in Nukufetau, Ellice Is., Tarawa and Tapetewea, Gilbert Is. (*A. G. Butler, Ann. Mag. Nat. Hist.* [5], XV, pp. 296-7). Again, in the small list of

insects collected by Mr. C. Hedley during the coral-boring expedition in 1896 to Funafuti in the Ellice Group (Rainbow, *Memoirs Austr. Museum*, III, part ii, p. 95), there is no mention of the occurrence of *D. plexippus*, nor is *Asclepias curassarica* included among the few plants noticed by him or by subsequent visitors as growing on that atoll. It is quite possible that the conditions of these small islands do not favour the growth of the plant.

III. THE WESTERN PACIFIC, AUSTRALIA, THE MALAY ARCHIPELAGO, &c.

The very interesting records of *Danaida plexippus* in the Western Pacific Islands, by my friend Paymaster-in-Chief G. F. Mathew, R.N., nearly thirty years ago, have been included in my previous paper (*Ent. Mo. Mag.*, vol. XXII, pp. 220, 221), and have been supplemented by my own observations made in 1900 in New Caledonia, the New Hebrides, and the Loyalty Islands (*l. c.*, vol. XXXVIII, p. 192, *et seq.*). I have, however, been unable to collect any information as to the date at which it first made its appearance in any of these island groups; but it probably reached this region very shortly after its arrival in the Central Pacific.

In the "Field" of April 16th, 1881 (p. 539), Mr. E. L. Layard gives the following very interesting notes on the butterfly and its food-plant as observed by him at Teremta, a French military post on the west side of New Caledonia, some sixty miles north of Nouméa—"A burst of sunshine and we are out on a sandy flat, also evidently subject to frequent overflow of the river . . . but now covered with a luxuriant growth of the pest-weed of that country, the "gendarmes plant" as it is called, second only to the *Lantana* in its powers of expansion and destructiveness. . . . Millions of huge red-brown butterflies sported among the flowers of this useless plant, their larvæ devouring the leaves in spite of the acrid milky sap they contain. It is strange that both plant and insect are introductions, and not natives of the colony. The former, an Asclepiad, is said to have been brought from Tahiti by a gendarme who had stuffed his mattress with the silky cotton of the pods. This he emptied out in his barracks near Nouméa, and the few chance seeds clinging to the cotton, finding a suitable soil, established themselves, and have thence spread all over the land. The butterfly (*Danais*) is an American insect that appeared suddenly in Australia. It was apparently introduced here in a case of plants by Père Montrouzier, the celebrated